

Guide to Privately Organizing an Aerial Spray for Forest Pests: Regulations and Recommendations

Table of Contents

- Introduction
- Definition and Requirements of Landscape and Forestry Sprays
 - Landscape
 - Legal requirements for aerial sprays over landscapes
 - Forest
 - Legal requirements for aerial sprays over forested
- Determining the Area to be Treated
- Deciding on a Pesticide
- Typical Timeline
- Appendix I: Non-Target Species Including Federal and State Endangered Species
 - Karner blue butterfly and aerial spray projects
 - Eagle nest avoidance
 - Other threatened or endangered species potentially affected by aerial sprays
- Appendix II: Pest Species Specific Information
 - Gypsy Moth
 - Forest Tent Caterpillar
 - Jack Pine Budworm and Spruce Budworm

Introduction

An aerial spray can be a cost effective way of dealing with a population of a forest pest that has increased to damaging levels over many acres. In many cases however, it is not as simple as just calling a sprayer to take care of the problem. This guide will take you through the steps of what is required and what should be considered for a safe, legal and effective aerial spray of tree feeding pests including gypsy moth, forest tent caterpillar, jack pine budworm, spruce budworm and others.

It is highly recommended that there be one individual or small group who coordinates the project within a residential area, contacting potential applicators, overseeing neighbor contacts, and having the authority to decide whether the spraying should be postponed due to unfavorable weather conditions. This person or persons should be willing to see the project through to completion. A consultant familiar with the pest and aerial spraying is also an option for privately-organized spraying. Although this will be more expensive, their expertise may be worth the cost.

Definition and Requirements of Landscape and Forestry Sprays

Whether the land you plan on treating can be defined as a forest or a landscape has consequences on what actions will be legally required of you as an organizer of an aerial spray or of your applicator.

Landscape ATCP 29.56(1)(d)

- means turf, ornamental and mulched areas, and areas being prepared for these purposes, that are located in or around residential premises, public or commercial facilities, parks, workplaces, care facilities, recreational areas and public lands. "Landscape" does not include utility or transportation right-of-way areas, greenhouses, nurseries, or areas used for agricultural production, forest production or commercial turf production.
- residential landscapes include wooded areas where there are greater than 1 residence per 5 acres (for the purposes of this guidance).
- example: an area that includes housing, parks, a golf course and the road ways within the larger area.

Legal requirements for aerial sprays over landscapes

The following rules have special implications or specifically apply to landscape aerial sprays. Applicators are expected to also adhere to all other regulations pertaining to aerial spraying not described here but included in Chapter ATCP 29 Pesticide Use and Control.

ATCP 29.50(2)(a) OVERSPRAY AND DRIFT, "No person may use or direct the use of a pesticide in a manner that results in pesticide overspray or significant drift." This regulation has particular importance to situations where many properties will be included in one aerial spray program, an example being a neighborhood or lake association that contracts for the entire community to be treated. If a person or persons within the spray block object to having their property treated, steps must be taken to prevent overspray or drift onto their property even if this means that some residents who want their property treated may not be able to be sprayed. There is no deadline for objectors to raise their objection to being sprayed and a legal complaint can even be brought after the spray has taken place. Spray organizers may consider obtaining a written release to allow the spray from each landowner within and adjacent to the proposed spray area to reduce the risk of objections being raised either before or after the spray. If a landowner within the treatment area does raise an objection, work with the applicator to determine the appropriate distance around that property that must be left untreated in order to avoid overspray or drift onto the objector's property.

29.56 (3), (4), (5) WARNING SIGNS POSTED, signs warning that the property has been treated with pesticide are required at all entries to the treated area and on each property within the treated area. ATCP 29.56(4) requires the signs be at least 4x5 inches and attached to a support, an example with all the required

information is shown in Appendix B to ATCP 29. ATCP 29.56(5) describes that these signs “shall be clearly visible from each point at which there is significant potential for human access to the treated area”. This is interpreted to mean that entries such as roads into the treated area would need to be posted as would each property within the treated area near the entry (driveway) to the property.

29.56 (8) ADVANCED NOTICE TO REGISTERED INDIVIDUALS, the applicator shall give at least 12 hours advanced notice to every individual who is currently registered to receive notice of that application under ATCP 29.56(7)

29.56 (2) and (6) INFORMATION TO CUSTOMER AND INFORMATION PROVIDED UPON REQUEST, the applicator shall provide the customer and any person who requests information about the landscape spray described in these sections.

29.31(5) COMMERCIAL APPLICATORS; CERTIFICATION CATEGORIES, the applicator hired to do the spray over a landscape must have certification in turf and landscape pest control. Spray organizers should be aware that this type of certification is unusual among Wisconsin aerial applicators and that they should ask specifically about it in the hiring process.

Forest

- A forested area for the purposes of an aerial spray is defined as an area covered with trees with less than 1 residence per 5 acres where the trees are not present for ornamental purposes.
- Example: Sixty acres of mixed deciduous trees managed for timber and wildlife with one residence and two outbuildings.

Legal requirements for aerial sprays over forests

While aerial applications over land designated as forest do not need to adhere to the requirements for landscape applications, as described in ATCP 26.56, they do need to honor all other relevant requirements of aerial pesticide application.

ATCP 29.50(2)(a) OVERSPRAY AND DRIFT also applies though typically forest applications are over one or a few owners properties so obtaining a release for treatment is not the issue it can be for landscape applications over multiple properties.

29.31(5) COMMERCIAL APPLICATORS; CERTIFICATION CATEGORIES, the applicator must be certified in forest pest control 29.31(4).

Determining the Area to be Treated

When planning an aerial spray, remember that this technique is most appropriate for large areas of simple square or rectangular shape. Aerial sprays for tree

pests typically involve a few to many landowners. A block size of 20 acres is a good starting point in situations where the treated area is surrounded by infested land. Treatment areas that are long and narrow, or oddly-shaped should be avoided because of potential problems with re-infestation and spray drift. When populations are high around the treatment area, caterpillars from outside may invade the treated area and reduce the effectiveness of the treatment along the borders. If populations are high around the treatment area, consider spraying an additional buffer of 150 or more feet around the area you want to protect. If this buffer will extend onto the property of another landowner, make sure you have the written permission of that landowner. Offering to pay for the buffer strip often helps in obtaining that permission.

If you only have an acre or two or a few large trees, a spray from the ground or application of a systemic insecticide into the soil or the tree itself may be a more appropriate treatment. An arborist or tree service can frequently do these treatments. To find a certified arborist in your area, go to the website of the Wisconsin Arborists Association at <http://www.waa-isa.org/index.htm>.

If you have decided that an aerial spray is the appropriate treatment for your situation, there are a few issues to consider in determining the area to be treated. To avoid wasting money and effort, define the area that is threatened and whether the owners are willing to pay for treatment.

The area that is threatened by an outbreak of a pest is the combination of where the pest is present in high numbers and where its favorite trees are located. Complaints of nuisance caterpillars or defoliation in the current summer are two easily observable indicators of potential problems next summer. Surveys of egg masses can also be done to predict the population for next year. Some of these surveys, such as the one for gypsy moth, are quite easy to do. Look in the appendices dealing with specific pests for directions on predictive egg mass surveys. Lists of the favored trees for each pest are also in the appendices. Consider the distribution of the favored hosts in the area you are considering spraying. You may be able to exclude some areas that would never be damaged because they have no favored trees. Conversely, you may want to extend your spray block to cover areas dominated by favored trees which are likely to be severely damaged by an outbreak. Aerial photos can indicate areas covered in broad-leaved trees such as oaks, areas dominated by conifers and the areas that are open fields. Aerial photos and maps can be obtained from internet sources such as Google Earth or Microsoft Virtual Earth. The Town or County Planning and Zoning Departments may also be able to help you with property maps.

While determining the area threatened, also keep in mind whether the landowners are likely to be willing to pay for its protection. The economic and emotional value of the trees is one factor to consider. In residential or recreational areas the trees are of much higher value, and therefore, tolerance for defoliation and tree mortality are much lower than in woodlots. In woodlots

the cost of spraying may exceed the value of the timber saved. Thus, a property owner whose land contains high value trees may be willing to pay for spraying, whereas a landowner with lower-value trees may not. However, trees growing on very sandy soil, those already in poor health, or those weakened by drought stress may suffer very heavy mortality and thus protection would be needed if catastrophic loss is to be avoided.

Depending on the size and severity of the infestation, you may find enough willingness to pay, or you may find that that within the proposed area, some property owners will pay, some won't pay but will allow their property to be sprayed if someone else pays, and some will neither pay nor allow their property to be sprayed. If collecting funds from individuals, it is recommended that the organizers collect more money than is theoretically needed from each property owner, because some people will agree to the spraying but then fail to send in their share of payment. Raising the funds through a lake or homeowners association is another option.

If you cannot raise enough interest and funds to pay for the spray initially planned, see if you could proceed with a modified plan. You may find a smaller core of homeowners who will pay to have their area sprayed. For example, you may have initially considered a 100 acre area but there is not enough interest to spray the whole area. However, there is a 20 acre core of adjacent homeowners who are interested and willing to pay and you could move forward with a spray of only that area.

Deciding on a Pesticide

Aerial applicators frequently have several pesticides available for use. Each one will have its advantages and disadvantages that you should consider when planning aerial spraying.

Bacterial insecticides containing the bacterium, *Bacillus thuringiensis* Kurstaki, (Btk) affect only small caterpillars and have an active life of 7-10 days once sprayed. Thus, they are fairly environmentally benign. They can also be safely used near water. Impacts on human health, wildlife, fish and other insects are minimal. In Wisconsin, these insecticides are the most commonly used for the treatment of defoliating forest pests.

The growth regulator Dimilin (a trade name for the insecticide diflubenzuron) kills leaf-eating insects by interfering with their molting process. However, these products can be extremely toxic to aquatic invertebrates and care must be taken to keep the pesticide out of bodies of water. Dimilin remains active for months, and thus environmental impacts are greater than with bacterial insecticides.

Chemical pesticides are much less specific and may kill any insects that contact them during their activity period. Thus, environmental impacts are greater than with bacterial insecticides. Carbaryl, an insecticide sold under a variety of trade names (e.g. Sevin), is extremely toxic to bees. Some chemical pesticides will break down quickly, whereas others will remain active for months. Carbaryl breaks down in about two weeks. The potential for adverse effects on human health is greater for chemical insecticides than for bacterial insecticides.

Typical Timeline

Summer before:

If you live in a residential or vacation area, talk to your neighbors while they and the caterpillars are present during the summer. They may also be displeased with the caterpillars and be interested in spraying next year. Once the caterpillars are only a memory, people tend to be less interested in spraying.

Fall:

I. Determine the area to be treated next spring.

II. If arranging spraying over multiple properties, obtain the permission (written recommended) of each landowner whose property is proposed for treatment. Most objections are for financial reasons, and many objectors will consent to having their property sprayed if the neighbors each chip in a few dollars and pay for it.

Winter:

I. Once you have decided which areas you want to spray, approach licensed aerial applicators. The Wisconsin Department of Agriculture, Trade, and Consumer Protection has a list of licensed aerial applicators on their website at <http://www.kellysolutions.com/WI/Applicators/searchbyCategory.asp>. Examination of the applicator's insurance and experience with forest pest spraying is recommended.

II. Once you have contacted applicators and received bids for the spraying, you will need to raise the money to pay for it. The cost per acre will be highly variable and depends on factors such as treatment area size and shape, flight distance, and whether the applicator is doing other spraying in the area. In recent years costs have ranged from about \$15-50 per acre, and are usually lower when a larger area is to be sprayed. In most cases, only one application of insecticide is done for tree pests but you may want to consult with your applicator if the population is particularly high.

Once sufficient funds have been raised and a contract signed, it's time to wait until early spring.

Spring:

I. By March, contact the applicator and determine how much advance notice he needs in order to spray your area at the appropriate time. Some applicators may only need a few days notice, while others may want more time.

II. There are some requirements for notifying property owners, and possibly other citizens who have requested to be notified of spraying occurring near their property. Project organizers are also encouraged to remind the property owners that the area will be sprayed soon. Homeowners may choose to stay indoors with the windows closed while spraying is occurring, to avoid direct exposure to the spray. To be on the safe side, those with severe asthma or food allergies may want to leave the area while spraying is occurring.

Individuals who have requested prior notification by placing themselves on the Dept. of Agriculture, Trade, and Consumer Protection notification list will have to be contacted at least 12 hours prior to the spray. Signs indicating pesticide treatment must also be up before the spray and left up until sunset the day following the spray.

III. Determining when to spray. Many sprays are more effective at specific stages of the insect's development. Sprays also must be applied when leaves are large enough to intercept the spray droplets. Consult with your applicator as to what information on insect and leaf development he or she will need to properly time the application of the insecticide you will be using. See the appendices on specific pests for information on how to monitor the development of the insect and its host for use in timing the application.

Spray Day:

Spraying is usually done during the early morning, because humidity is higher and winds are calmer than later in the day. The project coordinator should be on hand to determine whether the spraying should occur or be postponed due to unfavorable weather conditions. Consult with your applicator about weather conditions that would warrant delaying the treatment. Typically spraying should not occur if it is too windy or if significant rainfall is forecast before the product could dry on the leaves to prevent washing off.

Appendix I: Non-Target Species Including Federal and State Endangered and Threatened Species

Karner blue butterfly and aerial spray projects

Bald eagle nest avoidance

Avoiding injury to other threatened or endangered species potentially affected by aerial sprays

A. Karner blue butterfly and aerial spray projects

Can I spray for gypsy moth or other forest pests in areas where there might be Karner blue butterflies, an endangered species?

The Karner blue butterfly is a federally endangered species. You can see a map of its distribution in Wisconsin at <http://dnr.wi.gov/forestry/karner/>. Wisconsin has the largest population of Karner blues and a statewide program to protect this species and its habitat. This program is called the Wisconsin Statewide Karner Blue Butterfly Habitat Conservation Plan (HCP). Under this program, private landowners that fall within the “Voluntary Category” (as identified in the HCP) are allowed to conduct activities, such as spraying for gypsy moths or other forest pests, in areas that may support Karner blues.

To determine if you are in the “Voluntary Category” ask yourself the following questions:

Questions:

- Am I a forest landowner with less than 1000 acres?
- Am I a non-commercial forest landowner with greater than 1000 acres of land where the land is not primarily managed for the purpose of forestry (e.g., managed for recreation, as camps, or Lake Associations)?
- Am I an agricultural landowner?
- Am I a private property owner planning an insecticide spray to control a forest pest?
- Am I a local government or landowner association organizing an aerial spray of a forest pest?

Non-Voluntary Landowner Category (Regulated Landowners)

The following groups are not considered part of the “Voluntary Category” and are not authorized to spray

- Railroads
- Municipal, Cooperative or private utility or energy company

- Commercial Forests of > 1000 acres, (including county forests)
- Road or Highway departments
- Land developers
- HCP Partners

If you said yes to any of the “Questions” in the first section, and you do not fall into one of the “Non-Voluntary” landowner categories noted directly above, you can spray for gypsy moths in areas that support or may support the Karner blue. The current statewide permit covers this and other activities done by private landowners.

Will spraying for gypsy moth or other forest pests harm Karner blue butterflies?

It is possible that Karner blues can be harmed by spraying for forest pests such as gypsy moths. The commercially available insecticides that are used for controlling forest pests are known to kill Karner blue larvae and will adversely affect Karner blues if they are in the same spray block.

The HCP program recognizes that some Karner blue populations may be lost to spraying to control gypsy moth or other forest pests; these losses are expected to be small. Measures are being taken by the HCP partners to protect the butterfly in areas where recovery efforts are focused.

What can you do if you want to conserve Karner blue butterflies but also want to use an insecticide to prevent damage from gypsy moth or another forest pest?

The following suggestions can be used by private landowners to minimize impacts to Karner blues in the course of an insecticide treatment to manage forest pests such as gypsy moth. Some of these can be used to minimize impacts of spraying on other species of moths and butterflies.

Planning the Spray:

Aerial sprays can be planned to minimize the affect on Karner blue habitat. Options can include avoiding forest openings when spraying, changing the direction of application to avoid drift into Karner blue habitat, avoiding spraying on windy days, and adjusting the extent of aerial applications. When planning a spray, discuss the options with the DNR or your professional applicator.

Special Insecticides:

If you are spraying to control gypsy moth, the state Gypsy Moth Suppression Program has access to a gypsy moth-specific insecticide, Gypchek, which is not commercially available to private spray projects. If you have Karner blues on

your property and wish to avoid harming them, apply to the state Suppression program and alert them to the presence of Karner blues on the property and your interest in using Gypchek.

Temporary Cover:

Small patches of lupine and flowering plants can be protected from insecticide spray by covering them with a tarp during the spray application. Make sure you know when the application will be made as you don't want to leave the tarp on the plants for days. Take the tarp off once the spraying is complete and the plants and Karner blue larvae can continue their growth unaffected by the surrounding treated plants. This technique works best if the insecticide chosen is one with a short persistence like those using *Bacillus thuringiensis kurstaki* (Btk) as their active ingredient. If an insecticide with a long active life (persistent) is used, any insects that move away from the protected patch may be killed when they feed on treated plants.

Karner blue adults can colonize suitable habitat once the pesticide has degraded. If you use a pesticide with a short persistence like those using Btk as its active ingredient, Karner blue can return even the same summer to treated lands if there are abundant lupine and nectar plants and a nearby population of the butterfly.

Small Scale or Individual Treatments:

If your property is not part of a larger aerial spray block, you only have a few trees to protect and those trees are separated from other trees that won't be treated, you may consider a systemic insecticide treatment. Systemic insecticides are injected into the ground or into the tree and move with the sap into the leaves. Karner blue won't be exposed to insecticides within tree leaves as they only feed on lupine.

Non-Toxic Controls:

For a small area or a few trees, there are also non-toxic controls that can be used to manage moderate populations and to supplement insecticide treatments. Treating gypsy moth egg masses with a horticultural oil, protecting trees with sticky barrier bands or using burlap collection bands can help reduce gypsy moth on your trees without harming Karner blue butterflies or other species. Go to gypsymoth.wi.gov for management options for backyards.

What else can I do to help the Karner blue butterfly?

If you think that you may have Karner blues on your property or would like to learn more about what you can do to help protect and provide habitat for the butterfly please visit <http://dnr.wi.gov/forestry/karner/> .

By helping to conserve the Karner blue you would be joining the ranks of the 40 HCP partners and many additional private landowners in the on-going statewide effort to protect and recover this species and the imperiled habitat it lives in.

Your efforts to help conserve the Karner blue near lands where recovery of the butterfly is focused would be especially helpful. Those lands occur in areas termed Karner blue butterfly “Significant Population Areas,” and “Area of Conservation Emphasis”. Maps of those areas are available on the website noted above.

For additional information including contact information for someone to talk with, please visit the Wisconsin Karner blue butterfly website at <http://dnr.wi.gov/forestry/karner/>.

B. Bald eagle nest avoidance

Summary of Current Bald Eagle Protections

(by Cathy Carnes, USFWS, GBFO, Aug 17, 2007)

While the bald eagle was removed from the Federal List of Endangered and Threatened Wildlife on August 9, 2007, the eagle still remains protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act (Acts). Those Acts prohibit adversely affecting bald eagles. The U.S. Fish and Wildlife Service has developed the National Bald Eagle Management Guidelines (Guidelines) which provide general recommendations on how to avoid disturbing bald eagles. The Guidelines are based on several decades of behavioral observations, science, and conservation measures that can be taken to avoid or minimize adverse impacts to bald eagles. As pertains to aerial application of insecticides to control gypsy moths, the Guidelines recommend that aircraft avoid operating within 1,000 feet of active bald eagle nests. Adherence to the Guidelines will help people avoid violations of the law.

The Guidelines as well as other information on the bald eagle are available on the U.S. Fish and Wildlife Service' website at:
<http://www.fws.gov/migratorybirds/baldeagle.htm>

C. Avoiding injury to other threatened or endangered species potentially affected by aerial sprays

The State Endangered Species Law protects all animals wherever they occur; which includes everything from insects, such as moths and butterflies, to birds and other animals. The following section addresses only State or Federally listed Threatened or Endangered Species that could be affected by aerial spraying for gypsy moth or other forest pests. State Natural Areas are also included due to their sensitive nature. Review of the maps and adherence to the guidelines will help avoid violation of the law.

The Endangered Species County maps identify Sections with known occurrences of threatened or endangered species. These maps are intended to be used for planning and initial assessment of potential spray areas. The maps are available to the public at <http://dnr.wi.gov/org/land/er/nhi/CountyMaps/>.

If a Section on the map is highlighted, then restrictions would apply. If a spray area occurs in all or a part of a highlighted Section contact the Bureau of Endangered Resources to see what restrictions may apply to your designated spray area. Contact WDNR Bureau of Endangered resources at (608) 266-7012 or by e-mail at: bureau.endangeredresources@wisconsin.gov.

Threatened or Endangered Species. There are protected species that could be affected by aerial s-spraying. Rare moths and butterflies are particularly susceptible, as well as sensitive insectivorous birds, and birds that congregate in rookeries. Restrictions on the type of pesticide used would apply where these species are known to occur. Osprey and hawks are sensitive to disturbance at their nest sites from low flying airplanes and a minimum distance is required where nest sites are known.

Only those state or federally listed threatened or endangered species potentially affected by aerial spraying for gypsy moth or other forest pest are included in the following list. The assessment of whether a protected species occurs in a spray area will be determined by referring to the Endangered Species County maps at <http://dnr.wi.gov/org/land/er/nhi/CountyMaps/>. If your spray block occurs in part or all of a highlighted Section on the map, contact the Bureau of Endangered Resources for guidance on restrictions for that location. The Karner Blue Butterfly is not included on this list as it was addressed separately in a previous section.

- Northern Blue Butterfly
- Swamp Metalmark
- Frosted Elfin
- Powesheik Skipperling
- Silphium Borer Moth
- Phlox Moth
- Regal Fritillary
- Osprey
- Northern Goshawk
- Red-shouldered Hawks
- Great Egret
- Snowy Egret
- Cerulean Warbler
- Hooded Warbler
- Worm-eating Warbler
- Acadian Flycatcher

State Natural Areas (SNA) are specially designated areas of protection and aerial spraying is not permitted (unless specifically authorized), nor may spray drift onto a SNA. More than 90% of the plants and 75% of the animals on Wisconsin's endangered and threatened species list are protected on SNAs.

The locations of SNAs statewide are available at <http://dnr.wi.gov/org/land/er/sna/snamap.htm>, or by contacting the State Natural Area Program within the WDNR/Bureau of Endangered Resources. Check to see if your spray area is adjacent to a State Natural, notification of the State Natural Area Program in the DNR Bureau of Endangered Resources is required if spraying adjacent to a State Natural Area.

What can I do to help conserve endangered or threatened species in Wisconsin?

Your efforts to follow the guidance above are a great step in helping protect listed species. Be very careful as you decide where to spray, and ensure that the spraying is done as planned. Drift, although not intended, can be very harmful to many of the species listed above and other species as well. Use insecticides to only treat the pests, thus avoiding or minimizing impacts to rare species. Use small scale or individual treatments if possible, to avoid impacts to unintended habitats. Report rare species if you encounter them as you assess your site. Although only state or federally threatened or endangered species are protected by the State Endangered Species Law, we encourage protection of special concern species (so they don't get endangered) and rare plants pollinated by insects. This is particularly important for other rare moths and butterflies. Additional information on these species is available at <http://dnr.wi.gov/org/land/er/wlist/statelisted.asp>.

For additional information on State or Federally Threatened or Endangered Species please visit the WDNR Bureau of Endangered Resources website at: <http://dnr.wi.gov/org/land/er/>.

Appendix II: Pest Species Specific Information

Gypsy Moth
Forest Tent Caterpillar
Jack Pine Budworm and Spruce Budworm

A. Gypsy Moth

Favored tree species:

Oaks, all species
Aspens, trembling and big toothed
Birches except for yellow birch
Basswood and lindens
Apple and crabapple
Willows
Tamarack
Witch hazel
Hazel shrub
Service berry

These favored tree species will be fed on before less palatable species such as maples. For this reason, defoliation will be most severe and frequent on these trees.

Gypsy moth caterpillars will defoliate conifers such as white and red pine, spruce or hemlock once they are half grown. These and other conifers are at risk if they are adjacent to preferred broad-leaved trees the caterpillars can feed on when small.

Predictive surveys and using them to determine the area to be treated

While gypsy moth populations can increase over large areas, the intensity of the population can vary a lot within that area. When deciding where to treat, predictive surveys can be used to focus the treatment to those areas likely to be damaged if the pest population is not suppressed.

If you are planning to sample egg mass numbers, wait until mid-August in southern Wisconsin and Labor Day in northern Wisconsin. This will ensure that all of the egg masses have been produced by the time you sample. For a description on how to conduct egg mass surveys to predict next year's infestation levels, visit gypsymoth.wi.gov.

Take a few surveys throughout the area you are considering treating. If you see many egg masses on one end of the area but few on the other you may want to expand your treatment area or retarget your spray area to center on the area with the highest pest population. Also be aware that caterpillars can move short distances, up to 150 feet, and that if you have a concentration of preferred trees

such as oak or aspen to one side of a heavy infestation, the gypsy moth will likely move into these favored trees and cause damage even if there are few egg masses there at the time of survey.

Determining when to spray gypsy moth

When timing the spray application, take into account both the development of the caterpillars and size of the tree leaves.

Monitoring insect hatch and development. Before the eggs hatch, the project coordinator or designate should identify 25 or more egg masses within the treatment area to monitor for hatching. Select new (firm) masses that are at eye level or lower and are at least 6 inches from other masses. Around mid-April (in southern Wisconsin) or late April (northern Wisconsin), begin to check the masses every few days until you see the first small larvae on the masses. Then, check every 2 days and count the total number of larvae on the masses you have chosen to monitor. Estimate numbers if there are more than 100 larvae on a mass. You will see that the hatch starts off slow, picks up, and then drops off. Normally, spraying is about 10-14 days from the peak of the hatching. Hatching should be complete by the time spraying is done, and most caterpillars should be about 3/8" to 1/2" in length.

Monitoring leaf development. At the same time as hatch starts, monitor the oak leaf development in the area to be sprayed. Oaks will leaf out later than most species, but since oak is the gypsy moth's favorite species of tree in most treatment areas, focus on its leaf expansion. Typically, spraying occurs when the oak leaves are approximately 2-4" in length. Spraying too early results in too little leaf area to intercept the spray, and spraying too late results in the outer leaves intercepting most of the spray.

B. Forest Tent Caterpillar

Forest tent caterpillar is primarily a pest in the northern counties of Wisconsin, and periodic outbreaks occur over a large geographic area. Growth loss is the major impact, although trees can be weakened and become prone to mortality from other causes. The most common tree species affected are aspen and oak, with aspen being the most affected. Outbreaks and defoliation frequently occur for multiple years at a given site before the outbreak comes to an end. The presence of many large flies that often land on people is a sign that the outbreak is probably coming to an end. These flies attack the pupae of the forest tent caterpillar, leading to a decline in the caterpillar population. Note: gypsy moth caterpillars may be confused with forest tent caterpillars. Make sure the species is correctly identified before proceeding to organize spraying.

Predictive surveys and using them to determine the area to be treated

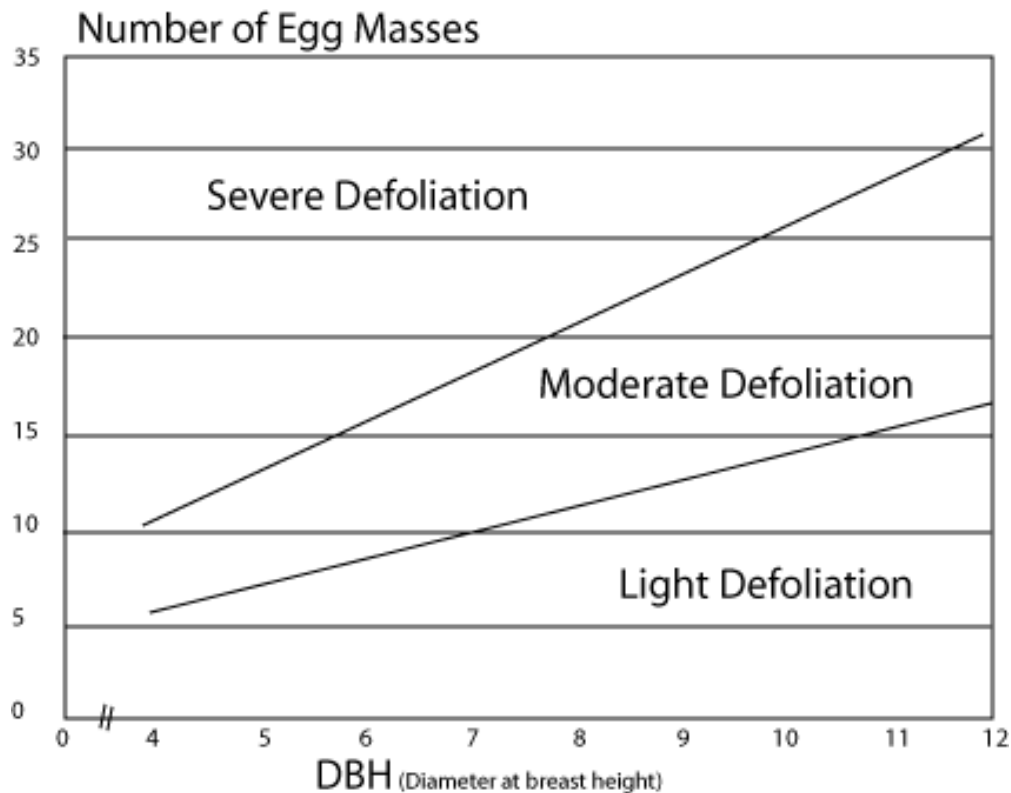
FTC defoliation is much less spotty in nature than is gypsy moth. If landowners track outbreaks by staying in touch with DNR entomologists they should have a good idea what the local populations will be like. In other words, landowners do not need to rely so much on local egg mass counts with FTC more on what the overall outbreak status is doing.

If you choose to do local surveys, the most accurate way to predict next year's forest tent caterpillar population is to cut down several trees and count the number of egg masses found on the tree. Thus, this survey method may not be suitable for residential areas. In residential areas, you could use other criteria such as nuisance and increasing defoliation during the previous summer or interest in treatment to determine the area to be sprayed.

This predictive survey should be done while the trees are leafless, late fall through early spring.

1. When the potential spray area is less than 50 acres, select two aspen trees to cut. For each additional 50-100 acres, select an additional two trees. Trees should be at least one hundred feet away from an adjacent travelled road. Since FTC tend to lay egg masses on tall trees, select the trees that are dominant or co-dominant (full crown and receiving full light from above). Choose aspen that are at least 6 inches in diameter at breast height (dbh). Avoid trees with many dead branches, as FTC moths tend to avoid trees in poor health.
2. Measure the dbh of the trees before you cut them down, and record on a tally sheet.
3. After you cut the tree, count the number of new egg masses on each tree, and record on the tally sheet. Egg masses are sturdy, cylindrical structures that encircle fine twigs. They are 1/4 to 3/4 inch long, covered with a glossy brown material that protects the egg contents during cold winters. You may find some old egg masses from last year, which are lighter in color. Count only new egg masses.

To predict the level of defoliation for the sample area, plot the average tree diameter and average number of egg masses per site on the graph. Actual defoliation will be influenced by weather conditions, size of the egg masses, number of egg parasites, etc. The decision to spray should be based upon factors such as the impact of the predicted defoliation on the trees and on the use of the property, tree health, stand management goals, and cost.



(Forest tent caterpillar defoliation prediction system developed by Forestry Canada, Manitoba)

Monitoring hatch – If possible, find several trees where there are numerous egg masses within 8-10' of the ground. Find a total of about 25 masses to monitor. In mid-April, begin monitoring these masses every day or two and record when the hatching begins on each mass. The hatching of the eggs should roughly coincide with the emergence of the leaves in the spring. Then, watch the development of the caterpillars, because the timing of spraying will be based on the size of the caterpillars and leaves. Monitor the size of the caterpillars on small trees, low-hanging branches and shrubs. The small larvae from an egg mass often cluster together on a group of small leaves.

If the area to be sprayed has a significant oak component (>25%), monitor the development of the oak leaves. Oaks will leaf out later than the aspens in the area. If there is only a minor oak component, monitor the aspen leaves instead.

The preferred period for spraying occurs when the caterpillars are 3/8" to 1/2" in length, and the leaves are about half their normal length (oaks are 3-4" and aspen are 1 1/2" to 2"). Normally this would be sometime in May in northern Wisconsin. If a second spray is planned, it should occur 3-5 days after the first.

When populations are very high, the small caterpillars may eat the foliage off as it appears. If this is the case, time the spraying only on the size of the caterpillars. Unfortunately, spray efficacy may be reduced because of the reduced leaf area to intercept the pesticide.

C. Jack Pine Budworm and Spruce Budworm

The cryptic feeding habits of early instar spruce budworms and jack pine budworms make these species difficult targets for insecticidal control. The most common insecticide used to control budworms is Btk. For both budworms the first life stage that can be targeted by Btk is the relatively free-feeding 4th instar caterpillars. Typically this stage would occur from late May to mid-June in Wisconsin. Since this is rather late for Btk applications, a single high dose approach appears logical. Applications should also be high volume in order to get the Btk down to the base of the needles. This is necessary because even the free-feeding larvae tend to feed primarily by clipping through the needles at their base.

If Btk is the insecticide of choice, spruce budworms should be sprayed about 7-10 days after all the bud caps have been shed from the new growth while jack pine budworms should be treated roughly two weeks after most of the male flowers stop shedding pollen. If pollen cones are scarce, spray when the new needles are $\frac{1}{2}$ to $\frac{3}{4}$ expanded. Btk has the advantage of being specific to caterpillars. Thus, it will not kill the parasites and predators of the budworms. Btk will not come close to a total kill of budworms but should provide enough control to keep the trees green and alive.

This guide was written by Bill McNee, Kyoko Scanlon, Shane Weber, Matt Krumenauer and Andrea Diss-Torrance of the WI Department of Natural Resources with input and review by Dave Fredrickson and Melody Walker of the WI Department of Agriculture, Trade and Consumer Protection, Dave Lentz of the WI DNR and Cathy Carnes of the US Fish and Wildlife Service.